SAND FILTER SIMPLE SIZING METHOD WORKSHEET

2005 Surface Water Design Manual Sizing Method

Project: _____

METHODS OF ANALYSIS (Section 6.5.2.1), Simple Sizing Method

Step 1) Determine whether a basic or large sand filter is needed.

See Core Requirement 8 of Section 1.2.8.

Basic or Large Sand Filter?	_____	Consult water quality menus in Section 6.1

Step 2) Determine rainfall region and regional scale factor.

Rainfall Region: Landsburg or Seatac?	_____	(unitless)	Required Figure 3.2.2.A
Regional Scale Factor:	_____	(unitless)	"

Step 3) Determine maximum depth of water above sand filter

d= maximum water depth above sand	_____	(ft)	Select now

Step 4) Determine site characteristics

For the simple sizing method, pasture is assumed grass and wetlands are assumed impervious.

Soil Type: Till or Outwash?		_____		See Table 3.2.2 B
T_i=	tributary area of impervious surface	_____	(acres)	Section 3.2.2.1
T_{tg}=	tributary area of till grass	_____	(acres)	"
T_{og}=	tributary area of outwash grass	_____	(acres)	"
Forest areas are ignored		_____	(acres)	

Step 5) Calculate minimum required surface area for sand filter

$A_{sf} = 0.7\ C_s(T_iA_i+T_{tg}A_{tg}+T_{og}A_{og})$

A_{sf}=	sand filter area	_____	(sf)	
0.7=	adjustment factor for routing effect	_____	(unitless)	
C_s=	regional scale factor	_____	(unitless)	From Step 2
T_i=	tributary area of impervious	_____	(acres)	From Step 4
T_{tg}=	tributary area of till grass	_____	(acres)	"
T_{og}=	tributary area of outwash grass	_____	(acres)	"
A_i=	filter area for impervious	_____	(sf/acre)	Table 6.5.2.A, Impervious column
A_{tg}=	filter area for till grass	_____	(sf/acre)	Table 6.5.2.A, Till Grass column
A_{og}=	filter area for outwash grass	_____	(sf/acre)	Table 6.5.2.A, Outwash Grass column

Step 6) Size the underdrain system

* The design criteria in "underdrain systems"(6.5.2.2) can be used in lieu of analyzing conveyance capacity for feeder pipes.
* The collector pipe, collecting flows from the underdrain system, shall be sized to convey the 2-year 15-minute peak flow with one foot of head above the invert of the upstream end of the collector pipe. Capacity can be checked using the "KCBW" standard step back water program.

KCRTS 2-year developed peak flow	_____	(cfs)	See Section 3.2.2
Rainfall Region: Seatac or Landsburg?	_____		See Figure 3.2.2.A
Soil Type: Till or outwash?	_____		See Table 3.2.2 B
Forest	_____	(acres)	Areas draining to swale (3.2.2)
Pasture	_____	(acres)	"
Grass	_____	(acres)	"
Wetland	_____	(acres)	"
Impervious	_____	(acres)	"
Scale Factor:	_____		See Figure 3.2.2.A
Time Step: hourly or 15-min?	*15-min*		Required "15 min" (6.2.1)
Data Type: Reduced or historic?	_____		Recommend "Reduced" (3.2.2.1)

Size Summary: Land area, Volume, and Cross Section

The land needed includes area for the pond, berms, access, and setbacks.

A_{top}= Pond top area, for Square, $(A_{sf}^{0.5}+2dZ)^2$		_____	(sf)	Calculate area at top of water
A_{sf}=	sand filter area	_____	(sf)	From Step 5
d=	maximum water depth above sand	_____	(ft)	From Step 3
Z=	side slope length per unit height	_____	(feet/ft)	Select now (Horizontal/Vertical)

Total volume equals volume of ponded water (V_{wq}) plus volume to convey the 100-yr flow.

$V_{wq}=(A_{top}+A_{sf})d/2$ ponded water volume _____ (ft^3)

Cross section includes underdrain system, sand depth (1.5 ft), and pond depth ("d," max 6 ft)

Pond depth _____ (ft)

OTHER DESIGN DETAILS (Section 6.5.2.2)

Pretreatment, Flow Spreading, Energy Dissipation
Overflow and Bypass Structures
Filter Composition and Specifications
Underdrain Systems
Grass Cover
Access Roads
Sequence of Facilities (Section 6.2.2)
Setbacks, Slopes, and Embankments (Section 6.2.3)
Liners (Section 6.2.4)
Presettling (Section 6.5.1)